

Hydrocissa albirostris treats Sparrows in the same manner. The day before yesterday [letter being dated Nov. 24, 1876] I found *Aceros subruficollis* discussing a rare Lory. I don't think that the habit is abnormal; for both birds manifest it and try to catch the smaller birds as they fly past. They are also very well cared for; and particular attention is paid to their food.

I am also rather astonished to find that *Hylobates hoolock* [the Gibbon] has a decided partiality for living birds, eating small living birds with avidity in the same way that *Nycticebus tardigradus* [the Slow Loris] does, seizing the bird by the body and always commencing at the head.

But I could dilate to the extent of some pages on the food and habits of Monkeys.

Further Remarks on the Lemming.
By W. DUPPA CROTCH, Esq., F.L.S.

[Read November 2, 1876.]

(PLATE XIII.)

THERE are three questions in the natural history of the Lemming which still require elucidation, viz. :—1. Whence do they come? 2. Whither do they go? and 3. Why do they migrate at all? With regard to the first of these, no one has yet supplied an answer. They certainly do not exist in my neighbourhood, which is the most elevated region in Scandinavia, during the intervals of migration; and I suspect that the Kjolen range is assigned to them merely because it is a comparatively unknown district. The answer to question No. 2 is certain: they go to the sea; those on the east of the backbone of Norway go to the Gulf of Bothnia, and those on the west to the Atlantic Ocean. The question as to the cause of these migrations remains; and to this, one of three answers has usually been given:—first, an unusual reproduction and consequent deficiency of food in their usual quarters; secondly, the foreknowledge of approaching severe weather, which is a very popular belief in Norway; thirdly, a natural tendency to descend the mountain-slopes both eastwards and westwards from the watershed between Sweden and Norway.

Now with regard to the first theory, I have invariably noticed during three migrations which I have witnessed, that, just as with the Swallows, one or two individuals have preceded the main body,

and that during the autumn, when the Lemmings first reach my neighbourhood, their number is never large; but after a winter spent beneath the snow, they begin to breed with the first days of summer, and thus develop the extraordinary multitude which is, as it well may be, the astonishment and terror of the country. I think, then, that excessive reproduction results from, and does not cause migration.

The second theory is the mere expression of a popular superstition which has been conclusively falsified during the greater migration of 1876-1877 as well as previously, and may, I think, be entirely omitted from our consideration.

The third theory, that these migrations follow the natural declivities of the country, will be best met by a reference to the diagrams (Pl. XIII.). The chart (fig. 1) shows the general main declivities of the Scandinavian peninsula. Fig. 2 is a plan of the district in which I have observed three migrations in ten years; in this the diagonal path of the Lemmings swimming across my lake in Heimdalen is very remarkable, and was confirmed by almost daily observation. Fig. 3 exhibits, in section, the foregoing plan. I also give a statement from the 'Verdens Gang,' No. 125, for Oct. 23, 1875, Christiania, for what it may be worth. "The proper home of the Lemmen is the Norsk High-Fjeld, both the Langfjelde and Kjölen, whence they migrate to the sea, either to the North Sea, the Atlantic Ocean, or the Gulf of Bothnia." Then follows a list of remarkable migrations:—

By Throndhjem, west.....	1580
„ Nordfjord „	1648
„ Tornea, east	1697
„ Lulea „	1737
„ Umea, „	1747
„ Throndhjem, west.....	1757
„ Kongsberg, south.....	1770
„ Hernosand, east	1823
„ Lyksele, „	1831
„ Bossekop, west	1833
„ Karrasuanda, east.....	1839

Now, assuming these facts to be accurate, which I confess I think, considering the ridiculous and improbable statements which accompany them, to be at least doubtful, there does certainly seem, at first sight, reason in the supposition that these

migrations follow the watershed, since the backbone of mountains in Norway runs nearly north and south. Thus reference to figs. 2 & 3, Pl. XIII., which gives the course of the Lemmings in 1867-68, 1870-71, and 1875-76, clearly shows that the natural slopes were not followed; and, again, reference to fig. 1 likewise shows that the main valleys in Norway run nearly north and south; whilst we find but one so-called southerly migration, that "by Kongsberg in 1770," respecting which I should much like to know more.

At all events, all these migrations end in the sea, and the Lemmings do not retrace their steps. Again, though four or five generations occur in one summer; the richest grass and the quietest quarters do not tempt the wanderers to remain and settle. I know nothing more striking in natural history than to see the holes, the well-marked runs, and the refuse of these restless creatures which so strangely appear and vanish, while their congener, the Field-Vole, remains in quiet possession of the quarters from which he was temporarily ousted. Probably this same Field-Vole is the only quadruped which does not wage successful war on the Lemmings; and the drawing given in the 'Verdens Gang' *l. c.*, only fails from omitting their enemies; in fact, if they were all depicted, there would be no room for the victims.

I think it must be admitted that, whether instinct be inherited reason or not, its primary object is for the benefit of the species. Here, however, this definition seems to fail just when it need not do so. By staying where they are, or by migrating southwards, most of the emigrants might live in such peace as is allotted to a Lemming; by migrating westward, or even eastward, they necessarily are drowned; but if in former ages land existed where the sea now rolls, a motive is found for these marvellous migrations, and collaterally a strong proof that what we call instincts are but the blind and, sometimes, even prejudicial inheritance of previously acquired experience.

The researches of the naturalists of the 'Challenger' Expedition have disclosed the existence of at least three ridges of submerged land in the Atlantic Ocean, extending some thousands of miles north and south of which the highest summits still remain as islands; and although the intervening valleys are of enormous depth, it may yet well be that lateral connecting ridges exist between those already discovered. Of course it is most improbable that the Lemmings ever journeyed so far south; probably

they did not even reach the "sunken land of Buz," to which 30° W. long. and $55^{\circ} 30'$ N. lat. is assigned; but it is very remarkable that the average depth from Norway to Iceland does not exceed 250 fathoms, with the exception of a deep and narrow channel of 682 fathoms at 14° W. This probably represented the old gulf-stream; and if this were so, the Lemmings did wisely to migrate westwards in search of its genial influence. As little by little the ocean encroached on the land, the same advantages would remain, as in fact they do to this day. But, owing to the rash confidence acquired by crossing with impunity so many lakes and fjords, this singular result is arrived at, that none of the travellers return to teach a lesson of caution to the survivors.

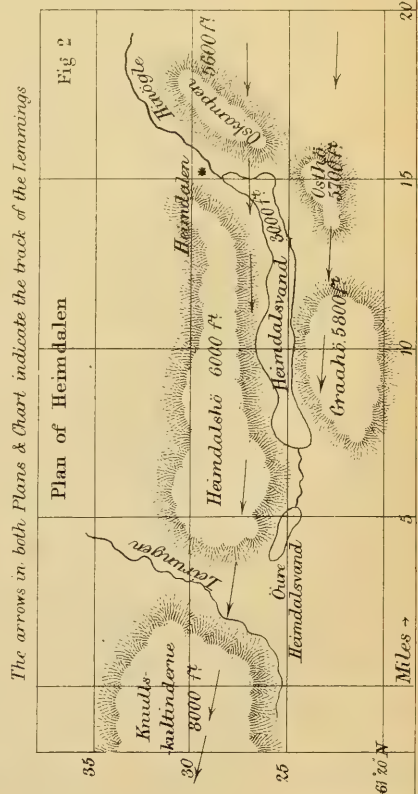
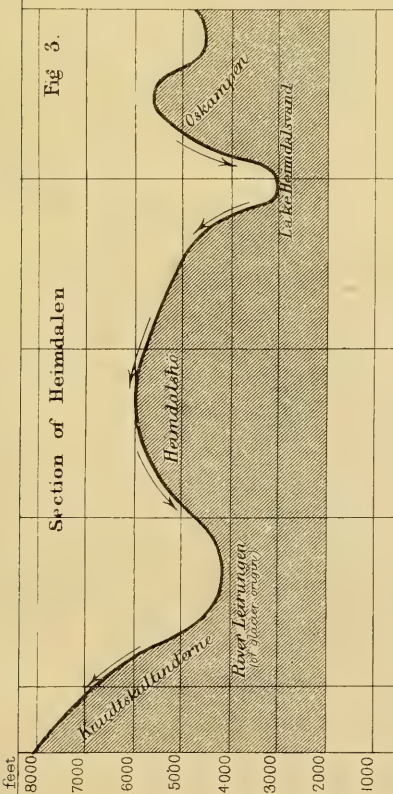
The submerged continent of Lemuria is held to explain many knotty points in the distribution of animals; and I think the existence of a Miocene Atlantis will be found to have a strongly elucidative bearing on subjects of even more interest than the migration of the Lemming. It is difficult to ascertain with any certainty the duration of life in these animals, since very few meet with a natural death. It is, however, clear that they survive the winter; and one which I have in captivity, as well as those now in the Zoological Gardens, are at least three months old. But the fact that the young soon leave their common nest and join the general band of migrants shows, I think, that they are actuated by a common impulse which is neither deficiency of food nor a mere gravitating tendency to roll down hill. It is true that many other animals share this tendency to westward migration; but that fact only intensifies the need of a satisfactory explanation, for which, until a better is found, I am constrained to propose the Miocene Atlantis*.

DESCRIPTION OF PLATE XIII.

- Fig. 1. Chart of Scandinavia. The two main valleys, Gudbrandsdalen and the valley of the Glommen, run nearly north and south. The course of the Lemmings crosses these at right angles.
- Fig. 2. In this plan of Heimdalen, drawn to scale, the course of the Lemmings will be seen to cross the Lake Heimdalsvand and the swift river Leirungen, both of which might be avoided by a slight detour.
- Fig. 3. A section of the same, showing the Lemmings' track, which does not follow the watershed.

The river Leirungen is of glacier origin, very cold and very rapid. Dogs do not like to face it; and yet the Lemmings cross it in thousands.

* [*Vide* Note "On the occurrence of the Lemming in Newfoundland," Zoologist, Feb. 1877, p. 47.—Ed.]



The arrows in both Plans & Chart indicate the track of the Lemmings

Stanford's Geog. Esab